AMENDMENTS TO THE CLAIMS

Please substitute the following claims for the pending claims with the same numbers respectively:

Claim 1 (Currently amended): A null symbol detection device used for receivers for a digital broadcasting system which repeatedly transmits a null symbol with smaller transmission power than those of other symbols during a fixed period, ~~which has at least one transmission mode,~~ where at least one of a null symbol repetition period and a null symbol width is different depending on at least one transmission mode, and in which the longer said null symbol repetition period becomes, the wider said null symbol width becomes, said null symbol detection device comprising:

an amplitude detector operable for detecting an envelope of at least one of an intermediate frequency signal and a baseband signal;

a synchronous addition buffer group having ~~at least one~~ a plurality of synchronous addition ~~buffer~~ buffers for synchronously adding data obtained by sampling an output of said

amplitude detector at a fixed sample period during said null symbol repetition period corresponding to said at least one of transmission modes to be received;

a transmission mode determination processor operable for performing a moving average operation upon all synchronous addition data rows stored in said at least one of synchronous addition ~~buffer~~ buffers of said synchronous addition buffer group, and for determining a transmission mode by detecting, with respect to a transmission mode to be received, a minimum value of the moving average operation and an address of said at least one of synchronous addition ~~buffer~~ buffers providing the minimum value; and

a null position detector operable for detecting, in accordance with a transmission mode determined in said transmission mode determination processor, a null symbol position from the address providing the minimum value of the moving average operation, and for generating a synchronous pulse at a start point of the null symbol position.

Claim 2 (Original): A null symbol detection device according to claim 1, wherein

said transmission mode determination processor includes:

a moving average processing unit for performing a moving average operation in which, with respect to all of the synchronous addition data rows stored in at least one synchronous addition buffer of said synchronous addition buffer group, an average value of adjacent m sampling values is calculated and the sampling point is successively moved, and for detecting the minimum value of the moving average operation and the address of said at least one synchronous addition buffer providing the minimum value for the transmission mode to be received;

a correction processing unit for correcting the minimum value of the moving average operation for each of the transmission modes performed in said moving average processing unit in accordance with a synchronous addition number and a time width of the moving average operation; and

a transmission mode determining unit for comparing corrected minimum values of the moving average operation for the respective transmission modes to determine the transmission mode to be received.

Claim 3 (Original): A null symbol detection device according to claim 2, wherein

the time width of the moving average operation in said moving average processing unit is equal to or less than the null symbol width of transmission mode having null symbol repetition period equal to a synchronous addition period of said at least one synchronous addition buffer.

Claim 4 (Original): A null symbol detection device according to claim 2, wherein

in said synchronous addition buffer group, synchronous addition is performed for numbers predetermined for each of said synchronous addition buffers, and a time period required for the synchronous addition is equal to a time period of said buffers with different synchronous addition periods.

Claim 5 (Original): A null symbol detection device according to claim 2, wherein

said correction processing unit normalizes the minimum value of the moving average operation calculated in said moving average processing unit by a value obtained by multiplying the

synchronous addition number by data corresponding to the time width of the moving average operation.

Claim 6 (Original): A null symbol detection device according to claim 2, wherein

said transmission mode determining unit compares the minimum value of the moving average operation corresponding to each of the transmission modes corrected in said correction processing unit with a predetermined threshold, and detects the minimum value among results of the moving average operation smaller than the predetermined threshold to determine a transmission mode, and when the minimum value smaller than the predetermined threshold is not provided, determines that a determination of the transmission mode is impossible.

Claim 7 (Original): A null symbol detection device according to claim 1, wherein

said transmission mode determination processor includes:

a moving average processing unit for performing a moving average operation in which, with respect to all of the synchronous addition data rows stored in said at least one of

synchronous addition buffer of said synchronous addition buffer group, an average value of adjacent m sampling values is calculated and the sampling point is successively moved, and for detecting the minimum value of the moving average operation and the address of said at least one of synchronous addition buffer providing the minimum value for the transmission mode to be received;

a threshold calculating unit for calculating thresholds for detecting a transmission mode by said synchronous addition data stored in said synchronous at least one addition buffer; and

a transmission mode determining unit for comparing the minimum value of the moving average operation calculated in said moving average processing unit with a threshold calculated in said threshold calculating unit to determine the transmission mode to be received.

Claim 8 (Original): A null symbol detection device according to claim 7, wherein

the time width of the moving average operation in said moving average processing unit is equal to or less than the null symbol width of a transmission mode having null symbol repetition

period equal to a synchronous addition period of said at least one of synchronous addition buffer.

Claim 9 (Original): A null symbol detection device according to claim 7, wherein

said synchronous addition buffer group performs the synchronous addition for same synchronous addition numbers regardless of the null symbol repetition period.

Claim 10 (Original): A null symbol detection device according to claim 7, wherein

said transmission mode determining unit detects all of the transmission modes to be received and, when detection of transmission mode cannot be performed successfully, outputs a mode undefined message indicating that the detection of the transmission mode to be received is impossible.

Claim 11 (Original): A null symbol detection device according to claim 2, wherein

the transmission mode to be received is in conformity with European Digital Audio Broadcasting (DAB) standard (ETS300401).

Claim 12 (Original): A null symbol detection device according to claim 7, wherein

the transmission mode to be received is in conformity with European Digital Audio Broadcasting (DAB) standard (ETS300401).

Claim 13 (Original): A null symbol detection device according to claim 11, wherein

said synchronous addition buffer group has three buffers which perform synchronous addition with periods of 24 msec, 48 msec and 96 msec, respectively.

Claim 14 (Original): A null symbol detection device according to claim 12, wherein

said synchronous addition buffer group has three buffers which perform synchronous addition with periods of 24 msec, 48 msec and 96 msec, respectively.

Claim 15 (Original): A null symbol detection device according to claim 11, wherein

in said synchronous addition buffer group, when a sample period of synchronous addition data in the synchronous addition buffer with a period of 24 msec is 1, a sample period of synchronous addition data in the synchronous addition buffer with a period of 48 msec is 2, and a sample period of synchronous addition data in the synchronous addition buffer with a period of 96 msec is 4.

Claim 16 (Original): A null symbol detection device according to claim 12, wherein

in said synchronous addition buffer group, when a sample period of synchronous addition data in the synchronous addition buffer with a period of 24 msec is 1, a sample period of synchronous addition data in the synchronous addition buffer with a period of 48 msec is 2, and a sample period of synchronous addition data in the synchronous addition buffer with a period of 96 msec is 4.

Claim 17 (Original): A null symbol detection device according to claim 16, wherein

in said synchronous addition buffer group, by using data sampled in the same period regardless of the synchronous addition period, the synchronous addition buffer with a period of 96 msec synchronously adds average values for four sample data, the synchronous addition buffer with a period of 48 msec synchronously adds average values for two sample data, and the synchronous addition buffer with a period of 24 msec synchronously adds one sample data.

Claim 18 (Original): A null symbol detection device according to claim 11, wherein

said moving average processing unit performs a moving average operation upon the number of samples corresponding to 0.5 τ to 1.0 τ in which τ indicates the null symbol width of the respective transmission modes.

Claim 19 (Original): A null symbol detection device according to claim 12, wherein

said moving average processing unit performs a moving average operation upon the number of samples corresponding to 0.5

τ to 1.0 τ in which τ indicates the null symbol width of the respective transmission modes.

Claim 20 (Original): A null symbol detection device used for receivers for a digital broadcasting system which repeatedly transmits a null symbol with smaller transmission power than those of other symbols during a fixed period, which has at least one transmission mode, where at least one of a null symbol repetition period and a null symbol width is different depending on at least one transmission mode, and in which the longer said null symbol repetition period becomes, the wider said null symbol width becomes, said null symbol detection device comprising:

an amplitude detector operable for detecting an envelope of at least one of an intermediate frequency signal and a baseband signal;

a synchronous addition buffer group having at least one synchronous addition buffer for synchronously adding data obtained by sampling an output of said amplitude detector at a fixed sample period during said null symbol repetition period corresponding to said at least one of transmission modes to be received;

a transmission mode determination processor operable for performing a moving average operation upon all synchronous addition data rows stored in said at least one of synchronous addition buffer of said synchronous addition buffer group, and for determining a transmission mode by detecting, with respect to a transmission mode to be received, a minimum value of the moving average operation and an address of said at least one synchronous addition buffer providing the minimum value; and

a null position detector operable for detecting, in accordance with a transmission mode determined in said transmission mode determination processor, a null symbol position from the address providing the minimum value of the moving average operation, and for generating a synchronous pulse at a start point of the null symbol position,

said transmission mode determination processor includes:

a moving average processing unit for performing a moving average operation in which, with respect to all of the synchronous addition data rows stored in at least one synchronous addition buffer of said synchronous addition buffer group, an average value of adjacent m sampling values is calculated and the sampling point is successively moved, and for detecting the

minimum value of the moving average operation and the address of said at least one synchronous addition buffer providing the minimum value for the transmission mode to be received;

a correction processing unit for correcting the minimum value of the moving average operation for each of the transmission modes performed in said moving average processing unit in accordance with a synchronous addition number and a time width of the moving average operation; and

a transmission mode determining unit for comparing corrected minimum values of the moving average operation for the respective transmission modes to determine the transmission mode to be received.

Claim 21 (Original): A null symbol detection device used for receivers for a digital broadcasting system which repeatedly transmits a null symbol with smaller transmission power than those of other symbols during a fixed period, which has at least one transmission mode, where at least one of a null symbol repetition period and a null symbol width is different depending on at least one transmission mode, and in which the longer said

null symbol repetition period becomes, the wider said null symbol width becomes, said null symbol detection device comprising:

an amplitude detector operable for detecting an envelope of at least one of an intermediate frequency signal and a baseband signal;

a synchronous addition buffer group having at least one synchronous addition buffer for synchronously adding data obtained by sampling an output of said amplitude detector at a fixed sample period during said null symbol repetition period corresponding to said at least one of transmission modes to be received;

a transmission mode determination processor operable for performing moving average operation upon all synchronous addition data rows stored in said at least one of synchronous addition buffer of said synchronous addition buffer group, and for determining a transmission mode by detecting, with respect to a transmission mode to be received, a minimum value of the moving average operation and an address of said at least one synchronous addition buffer providing the minimum value; and

a null position detector operable for detecting, in accordance with a transmission mode determined in said

transmission mode determination processor, a null symbol position from the address providing the minimum value of the moving average operation, and for generating a synchronous pulse at a start point of the null symbol position,

said transmission mode determination processor includes:

a moving average processing unit for performing a moving average operation in which, with respect to all of the synchronous addition data rows stored in said at least one of synchronous addition buffer of said synchronous addition buffer group, an average value of adjacent m sampling values is calculated and the sampling point is successively moved, and for detecting the minimum value of the moving average operation and the address of said at least one of synchronous addition buffer providing the minimum value for the transmission mode to be received;

a threshold calculating unit for calculating thresholds for detecting a transmission mode by said synchronous addition data stored in said synchronous at least one addition buffer; and

a transmission mode determining unit for comparing the minimum value of the moving average operation calculated in said moving average processing unit with a threshold calculated in

said threshold calculating unit to determine the transmission mode to be received.